

## FUEL AND ENERGY RESOURCES AND PRIORITY DIRECTIONS FOR DEVELOPMENT OF ELECTRIC POWER COMPLEXES IN THE COUNTRIES OF THE TURKIC WORLD

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### Abstract

The article examines the current state of the power complexes of the Turkic World Countries (TWC), including the total reserves of existing energy carriers and their per capita consumption, the generation capacity of various types of power plants, and electricity production. Here, the economic indicators of the TWC's energy complexes are analyzed, and their share indicators among the world's countries are calculated. The article also discusses the impact of local natural resources in these countries on the development of energy complexes and the issues of expanding the use of renewable energy sources (RES), as well as the similarities and differences between the Turkic States. In writing the article, relevant literature samples on energy and statistical materials of relevant agencies were used, as well as schemes and diagrams.

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### 1. Introduction

The rapidly accelerating globalization processes in the modern era have led to several fundamental changes in the political and economic development of the world's countries. These changes, in turn, have led to the improvement of financial and monetary systems through the application of modern economic innovations at both the international and national levels, the organization of efficient use of natural resources, the development of various economic sectors, and the further increase in competition for world markets. In such a situation, a group of countries distinguished by their geostrategic importance, favorable natural conditions, rich natural resources, and human resources has emerged on the modern political map of the world, which includes the Turkic States. In recent years, the integration of independent Turkic states (Azerbaijan, Turkey, Kazakhstan, Uzbekistan, Turkmenistan, and Kyrgyzstan) into the political, economic, and cultural life of the world and their role in the international economy have been increasingly strengthened. The total trade turnover of the Turkic states with the countries of the world, which occupy the most important geostrategic position in Eurasia, is 1.3 trillion, and within the

framework of the Organization of Turkic States (OTS), it is 60 billion. This is evidenced by the fact that their foreign trade turnover has reached USD 1.5 trillion (approximately 4-5% of foreign trade turnover) and their Gross Domestic Product (GDP) is over USD 1.5 trillion. Turkic states, which have an area of 4.8 million km<sup>2</sup> (3.3% of the world's land area), abundantly endowed with diverse natural resources, especially fuels such as oil, natural gas, coal, and uranium [3].

### 2. Material and method

In writing the article, research materials and statistical data related to the energy sector of the International Energy Agency (IEA), EAEC (Eurasian Energy Space), and the Energy Agency of the Republic of Kazakhstan were used. When conducting the research, preference was given to the use of statistical, comparative analysis, etc., methods.

### 3. Analysis and discussion.

*3.1. Azerbaijan: Energy Sector Overview.* Azerbaijan, with a territory of 86.6 thousand km<sup>2</sup>, ranks sixth in area and fourth in population among the Turkic states. It accounts for about 0.06% of the world's land area (148.94 million km<sup>2</sup>) and nearly 0.4% of the total area of the Turkic states (22.1 million km<sup>2</sup>). The country's population of

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10 million people makes up 0.13% of the global population (7.95 billion) and 3.5% of the population of the Turkic states (287 million). In terms of economic size, Azerbaijan generates around USD 161.4 billion GDP, which equals 0.15% of global GDP (USD 105 trillion) and 2.1% of the GDP of the Turkic states (USD 7.7 trillion). The fuel and energy sector plays a decisive role in the structure of the national economy and contributes significantly to GDP formation.

Azerbaijan is rich in natural resources. It holds about 0.2% of the world's total reserves of primary energy resources (1,428.6 billion tons of oil equivalent) and 1.1% of Eurasian reserves (307.8 billion tons of oil equivalent). Of this, crude oil accounts for 1.48 billion tons of oil equivalent (0.4% globally; 5.8% in Eurasia), while natural gas stands at 1.86 billion tons of oil equivalent (0.6% globally; 2.2% in Eurasia). The country's per capita consumption of energy carriers is about 1,070 kg per person, which is lower than the global average of 1,238 kg and almost half the Eurasian average of 2,041 kg.

Despite its relatively small territory, Azerbaijan's proven recoverable oil and condensate reserves are estimated at 1.5 billion tons, while natural gas reserves amount to 2.5 trillion cubic meters. About 70% of its territory is regarded as highly prospective for hydrocarbons, and nearly 90% of these resources are located in the Caspian Sea. The country's leading oil fields are mostly offshore, such as Gunashli, Azeri, Chirag, Alov, Dan Ulduzu, Inam, Oghuz, Ashrafi, and Karabakh, while important onshore fields include Bibiheybat, Pirallahi, Yasamal, Mollakend, Muradkhanli, Garachala, and Siyazan. In terms of natural gas, the main offshore fields are Shah Deniz, Umid, and Absheron, whereas the most significant onshore fields include Garadagh-Gobustan and Guzdek-Zira.

Azerbaijan also possesses notable oil shale reserves. The largest deposits are concentrated in Jangichay (73.4 million tons), Kichik Siyaki (56.3 million tons), Boyuk Siyaki (56.2 million tons), Kecheller (51.9 million tons), and in the Gobustan region, where the total forecast reserves are estimated at 430–450 million tons. However, although these resources have the potential to satisfy domestic fuel demand, they remain largely undeveloped and are not yet used in the country's energy balance.

Azerbaijan's rich natural fuel resources have stimulated the development of several economic sectors, with the energy industry occupying a

central place. Energy production, which has been steadily expanding since the early 20th century, has become one of the most strategically significant sectors of the national economy. In 2021, Azerbaijan accounted for approximately 0.1% of the global installed power generation capacity (8,072,850 MW) and 1.7% of the total capacity in Eurasia (459,760 MW), with an installed capacity of 7,965 MW.

Of this total, 6,694 MW was provided by thermal power plants (84.0%), 1,157 MW by hydropower plants (14.5%), 66 MW by wind farms (0.8%), and 48 MW by solar plants (0.6%) [6]. Electricity production amounted to 27,889 million kWh, which represented 0.09% of global generation (28,322.97 billion kWh) and 1.6% of Eurasia's output (1,670.88 billion kWh). This level of production fully satisfied Azerbaijan's domestic electricity demand. As in many other Turkic states, thermal power plants remain dominant, generating 26,465 million kWh (94.8%), while hydropower accounted for 1,277 million kWh (4.5%), combined heat and power plants for 91 million kWh (0.3%), and other small hydropower stations for 56 million kWh (0.2%).

Per capita electricity consumption in Azerbaijan reached 2,033 kWh/person, which is lower than the global average of 3,102 kWh/person (1.5 times less) and the Eurasian average of 4,064 kWh/person (1.9 times less) [6].

The country's largest power plants include the Azerbaijan Thermal Power Station (2,400 MW), Southern TPP (780 MW), Sumgayit TPP (525 MW), Northern TPP (409 MW), Baku TPP (106 MW + 105 MW units), Mingachevir HPP (424.6 MW), Shamkir HPP (380 MW), and Yenikend HPP (150 MW), among others. Recent statistics show a steady increase in capacity. By 2023, the installed capacity of Azerbaijan's thermal power plants had risen to 8,322 MW, of which 6,633 MW came from conventional fossil-fuel plants and 1,689 MW from newly commissioned facilities, including biomass-fired and modernized units [12].

*3.2. Turkey: Energy Sector Overview.* Turkey, with a territory of 783.5 thousand km<sup>2</sup> and a population of 84.68 million, accounts for 0.6% of the world's land area and 3.5% of Eurasia, as well as 1.11% of global population and 28.5% of Eurasia's population. It is the second largest country in area and the largest in population among the Turkic states. Turkey's GDP in 2021 was USD 2,965.4 billion, corresponding to 1.7% of the world's GDP and 38.0% of the GDP of Turkic states [9].

The country's total energy reserves are estimated at 3.776 billion tons of oil equivalent, representing 0.2% of the world's total reserves and 1.2% of Eurasia's reserves. Crude oil accounts for 0.079 billion tons (0.02% globally; 0.3% in Eurasia), natural gas for 0.005 billion tons (0.0018%; 0.006%), and coal for 3.692 billion tons (0.4% globally; 1.8% of Eurasia). Per capita energy consumption was 1,424 kg/person, which is 1.1 times above the global average but 1.4 times below the Eurasian average [9]. Major natural fuel resources include coal (reserves of 11.4 billion tons, Erengil-Zonguldak deposit, the largest brown coal deposit in the Middle East), oil (47–50 million tons in southeastern and southern Turkey and the Chukurova lowlands), and natural gas (7.0 billion m<sup>3</sup> in the Tigris upper reaches, Batman, Eregli-Sinop, and Adana regions). Recent discoveries of oil and gas in the Eastern Mediterranean are expected to further boost the economy [4, p. 122].

In 2021, Turkey had an installed power generation capacity of 99,820 MW, accounting for 1.24% of global capacity and 21.7% of Eurasian capacity. Thermal power plants contributed 47,820 MW (47.9%), hydroelectric plants 31,493 MW (31.5%), other hydroelectric units 10,607 MW (10.6%), additional hydroelectric units 7,816 MW (7.8%), geothermal plants 1,676 MW (1.7%), and other sources 408 MW (0.4%) [9]. Electricity generation reached 334,723 million kWh (1.1% globally; 20% in Eurasia), with thermal plants producing 222,623 million kWh (66.5%), hydroelectric plants 55,927 million kWh (16.7%), other hydroelectric units 31,437 million kWh (9.4%), additional hydroelectric units 13,943 million kWh (4.2%), and geothermal plants 10,793 million kWh (3.2%).

Turkey's power plants primarily rely on imported oil and gas as well as local coal, with the fuel mix including fuel oil (31%), natural gas (28%), and coal (28%) [4, p. 122]. Per capita electricity consumption was 3,337 kWh/person, approximately twice the global average but 1.9 times below the Eurasian average. The largest power plants are the Euphrates River HPP cascade: Atatürk (2,405 MW), Karakaya (1,880 MW), Keban (1,330 MW), Birecik (672 MW), and Karkamish (189 MW) [9].

To meet growing electricity demand, Turkey has begun constructing 19 new HPPs in South-eastern Anatolia, along with nuclear power plants planned by TAEC. The AKKUYU NPP units, with a combined capacity of 1,114 MW, started construction between 2018 and 2022 in the Mersin region [14]. In recent years, as in other Turkic

countries, Turkey has also been experiencing increases in the production capacity of power plants. This is evidenced by the fact that in 2023, the production capacity of the country's power plants reached 107.27 million kWh (including thermal power plants at 47.81 million kWh and RES at 59.46 million kWh (hydroelectric power plants—31.96 million kWh, wind power plants—11.81 million kWh, solar power plants—14.00 million kWh, and geothermal power plants—1.69 million kWh) [12].

*3.3. Kazakhstan: Energy Sector Overview.* Kazakhstan has an area of 2,724,900 km<sup>2</sup> (2.09% of the world; 12.2% of Eurasia) and a population of 19.01 million (0.25% globally; 6.39% of Eurasia). The country ranks first in terms of area and third in terms of population among the countries of the Turkic world countries. Its GDP is 545,187 billion dollars (0.3% of the world; 7.0% of Eurasia). [7]. Kazakhstan, which is very rich in natural resources, has a total energy reserve of 34,908 billion tons of oil equivalent (2.4% of the world; 11.3% of Eurasia), of which 6,350 billion tons of oil equivalent (1.8% of the world; 25.2% of Eurasia), 3,455 billion tons of natural gas equivalent (1.2% of the world; 4.1% of Eurasia), and 25,102 billion tons of coal equivalent (3.1% of the world; 12.8% of Eurasia). The sufficient availability of energy carriers in the country also had a positive impact on per capita consumption, which amounted to 2537 kg/person, which was 2 times higher than the world indicators and 1.2 times higher than the Eurasian indicators [7]. Kazakhstan, which ranks 6th in the world in terms of the richness of its minerals, has a sufficient number of valuable fuels, including gunpowder, zinc, tungsten (1st place), silver, chromite (2nd place), copper, fluorite (3rd place), molybdenum (4th place), gold (6th place), etc., natural resources. These include oil (reserves of 20–25 billion tons); according to preliminary estimates, the Caspian sector of the country is considered more promising in this regard, and its reserves are estimated at 13 billion tons of oil equivalent. Main deposits: Uzen, Metilay, Karajambash, Kalamkas, Tengiz, Kenkiyak, Karachiganak, Kumkol, Kashagandyr, etc.), natural gas (the country's main gas deposits, estimated at 6 trillion m<sup>3</sup>, and ranking 12th in the world in terms of reserves, are located in the West Kazakhstan region), coal (the deposits with a projected reserve of 164 billion tons are mainly located in Karaganda, Pavlodar, Kostanay, and Ekibastuz (50 million tons of coal are extracted from this deposit per year; in recent years, the Maykoben and Torgay coal basins have also be-

gun to be exploited)) [4, p. 37], uranium (in 2022, Kazakhstan provided 43% of the world's total uranium production, and the presence of sufficient reserves in these deposits (worldwide 21% (II place), which gave impetus to the construction of the country's first nuclear power plant (currently the Mangistau nuclear power plant) in Aktau in 1972)), etc. can be an example [13]. In Kazakhstan, the fuel needs of the energy industry are completely met by natural resources such as local oil, gas, coal, and uranium. The current generation capacity of power plants operating in the country based on the use of these resources reaches 26803 MW (0.34% in the world; 5.83% in Eurasia), of which the majority are 21956 MW of thermal power plants (81.9%), 2806 MW of hydroelectric power plants (10.5%), 672 MW of hydroelectric power plants (2.5%), and 1369 MW of hydroelectric power plants (5.1%) [7].

In recent years, increases in the total generation capacity of existing power plants and electricity production have been observed in Kazakhstan. Thus, in 2021, electricity production in the country reached 115,074 million kWh (0.4% in the world; 6.9% in Eurasia), of which 102,494.0 million kWh was provided by thermal power plants (89.0%), 9,208 million kWh by hydroelectric power plants (8.01%), 1,747 million kWh by hydroelectric power plants (1.52%), and 1,625 million kWh by hydroelectric power plants (1.42%). Per capita electricity consumption in the country was 4,572 kWh/person, which was 1.4 times higher than the world average and 1.1 times higher than the Eurasian average. The largest HPPs in the country are Ekibastuz-1 TPP (4000 MW), Ekibastuz-2 TPP (1000 MW), and Aksu TPP (2400 MW); Cascade stations: Shulba, Bukhtarma, and Oskemen HPPs (on the Irtysh River), Kapchagay HPP (on the Ili River), Chardara HPP (on the Syrdarya River), etc. It should be noted that although Kazakhstan has a sufficient number of RES, their share in electricity production is still very small. The country's hydropower potential alone is estimated at 163 billion kWh, of which 62 billion kWh is technically usable, and 27 billion kWh is economically viable [13].

Statistical indicators for 2023 show that the total generation capacity of Kazakhstan's power plants reached 26,884 MW, and most of this, namely 20,221 MW, was again non-renewable (thermal power plants using organic fuels), and 5,663 MW was renewable energy sources (thermal power plants burning biomass (14 MW), hydroelectric power plants (2,903 MW), hydro-

electric power plants (1,440 MW), and solar power plants (1,306 MW) [12].

*3.4. Uzbekistan: Energy Sector Overview.* Uzbekistan ranks 4th in terms of area and 2nd in terms of population among the TDCs. The country has an area of 447.4 thousand km<sup>2</sup> (0.35% in the world; 2.01% in Eurasia) and a population of 34.56 million people (0.46% in the world; 11.6% of Eurasia). Its GDP is 300.171 billion dollars (0.1%; 3.85%) [11].

In Uzbekistan, which has a total reserve of energy carriers of 3.247 billion tons of oil equivalent (0.23% in the world; 1.05% in Eurasia), the share of crude oil is 0.126 billion tons of oil equivalent (0.03% in the world; 0.5% in Eurasia), natural gas is 2.353 billion tons of oil equivalent (0.8%; 2.8%), and coal is 0.768 billion tons of oil equivalent (0.09% in the world; 0.3% in Eurasia). However, despite the fact that the per capita consumption of energy carriers in the country has reached 1102 kg/person, this is still 1.1 times lower than the world average and 1.8 times lower than the Eurasian average [11].

Uzbekistan is a country that is very rich in natural resources. The country's fuel resources include oil (reserves are estimated at 5 billion tons, and the main deposits are located in the provinces of Kashgar, Bukhara, Surkhandarya, Namangan, Andijan, Fergana, etc.); natural gas (reserves are 5 trillion m<sup>3</sup>; the largest gas fields are Gazly (initial gas reserves are estimated at 470 billion m<sup>3</sup>), Uchkir, Zevardi, Mubarak, etc.); and coal (in the Surkhandarya region, Shargun (37.3 million tons) and Baysun (15.6 million tons), and gray coal reserves are concentrated in the Angren field (1926.7 million tons). The country's coal reserves are completely used for local electricity production; uranium (the discovered reserves of which reach 55 thousand tons, which may give impetus to the development of nuclear energy in this country in the future), etc., can be an example [4, p.78].

The energy industry of Uzbekistan is mainly represented by thermal and hydroelectric power plants. In 2021, the current production capacity of these power plants was increased to 16,700 MW, which is 0.21% in the world and 3.64% in Eurasia, of which 14,543 MW were thermal power plants (87.09%), 2,052 MW were hydroelectric power plants (12.29%), 1 MW was wind power plants (0.001%), and 104 MW were solar power plants (0.64%). In the same year, the power plants operating in the country produced 71,413 million kWh. The majority of the electricity (0.2% in the world; 4.2% in Eurasia), i.e., 66391 million

kWh, was provided by thermal power plants (93%), and 5022 million kWh by hydroelectric power plants (7.0%) [11]. Although the per capita electricity consumption in the country was 1610 kWh/person, this was 1.9 times lower than the European indicators and 2.5 times lower than the Eurasian indicators.

Observations show that in recent years, taking into account the growing electricity demand, the country has increased its focus on developing nuclear energy (for this purpose, an agreement was signed with Russia on the construction of a 330 MW nuclear power plant in 2024) and the use of renewable energy sources. An example of this is the construction and commissioning of wind and solar power plants in the Navai, Jizak, Samarkand, and Surkhandarya regions and the planning of the construction of 10 large KES with a total capacity of 10.3 GW in the Karakalpakstan Autonomous Republic. In addition, Uzbekistan, which is implementing the "Sunny House" program in the field of "Green Energy," plans to build another 11 solar and wind power plants with a total capacity of 4.8 GW (worth USD 4.4 billion) under an agreement concluded with China (2023). Thus, Uzbekistan plans to increase the total production capacity of renewable energy sources by another 20 GW by 2030, bringing its share in the energy balance to 40% and, starting from the same year, export excess green electricity (approximately 10-15 billion kWh) to foreign countries [5].

At the end of 2023, as in other Turkic states, increases were observed in Uzbekistan's existing energy sources. The generation capacity of power plants was increased to 17,901 MW, of which 15,232 MW came from non-renewable energy sources (thermal power plants running on organic fuel) and 2,669 MW from renewable energy sources (hydro power plants—2,415 MW; wind power plants—1 MW; solar power plants—253 MW) [12].

*3.5. Turkmenistan: Energy Sector Overview.* Turkmenistan has an area of 488.1 thousand km<sup>2</sup> (0.38% of the world's area; 2.19% of the Eurasian area) and a population of 6.342 million people (0.09% in the world; 2.13% in Eurasia). The country ranks third in terms of area and sixth in terms of population among the TDCs. Its GDP is \$104.31 billion (0.06% in the world; 1.34% in Eurasia) [10].

The total reserves of energy carriers available in Turkmenistan are estimated at 13.171 billion tons of oil equivalent (0.9% of the world, 4.2% of Eurasia), of which 0.127 billion tons of oil

equivalent (0.03% of the world; 0.5% in Eurasia) are crude oil, and 13.171 billion tons of oil equivalent (4.7% of the world; 15.7 billion tons of oil equivalent) are natural gas. As in Kazakhstan, the per capita consumption of energy carriers in this country is higher than both the world (2.6 times) and Eurasian indicators (1.6 times), reaching 3296 kg/person [10]. In Turkmenistan, which has rich oil and, in particular, natural gas reserves, all economic sectors are developed based on the use of these reserves. Of the 144 oil and gas fields discovered in the territory, 40 (Caspian, Bukhara-Khiva, Mary, Lebap, etc.) are exploited. The main oil fields are Goturtepe and Barsagelmez; the natural gas fields are Shadliq, Achak, Naib, etc. In some regions of the country, which ranks 4th in the world in terms of natural gas reserves and 11th in terms of production, coal deposits are found, albeit small [4, p. 101].

In 2021, the current generation capacity of Turkmenistan's thermal power plants reached 6,511 MW (0.08% in the world; 1.42% in Eurasia), of which 6,510 MW (99.9%) were thermal power plants and 1 MW (0.1%) was hydroelectric power plants. In the same year, the country produced 22,534 million kWh of electricity (0.07% in the world; 1.3% in Eurasia), most of which, namely 22,528 million kWh (99.9%), was provided by thermal power plants, and a small part by hydroelectric power plants.

Examples of power plants operating in Turkmenistan include Mari State DRES (1685 MW), Turkmenbashi Thermal Power Plant (420 MW), Balkanabad HPP (360.2 MW), Abadan HPP (321 MW), Ashgabat HPP (254.2 MW), Ahal HPP (254.2 MW), Avaz HPP (254.2 MW), and Dashaguz HPP (254.2 MW), as well as Hindigush, "Vatan," Darvaz, Lebap, etc. [10].

By the end of 2023, the production capacity of existing energy sources in Turkmenistan was increased to 7002 MW, of which 7000 MW was again allocated to thermal power plants operating on fossil fuels, and only 2 MW to hydroelectric power plants [12].

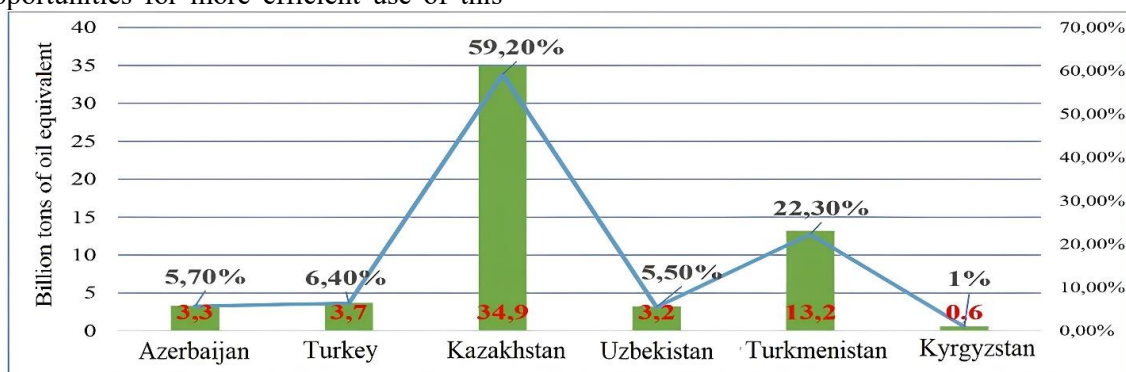
*3.6. Kyrgyzstan: Energy Sector Overview.* Kyrgyzstan, which ranks fifth in terms of area and population among the Turkic world countries, has an area of 199,951 km<sup>2</sup> (0.16% of the world's area; 0.9% of the Eurasian area) and a population of 6.654 million people (0.09%; 2.24% of Eurasia). The country's GDP is 36.549 billion dollars (0.02%; 0.4%) [8]. The total reserves of natural energy carriers in Kyrgyzstan are estimated at 0.568 billion tons of oil equivalent (0.04% of the world's area; 0.18% of the Eurasian area), of

which 0.008 billion tons of oil equivalent (0.002%; 0.03%), 0.007 billion tons of natural gas equivalent (0.002%; 0.008%), 0.553 billion tons of oil equivalent (0.002%; 0.008%), and 0.553 billion tons of oil equivalent (0.002%; 0.008%) are accounted for by coal (0.06%; 0.2%). The relatively low natural resource potential of the country compared to other Turkic states has led to the fact that the per capita consumption of energy carriers (494 kg/person) is 2.5 times lower than the world indicators and 4.1 times lower than the Eurasian indicators [8]. Despite the fact that Kyrgyzstan's industrially significant oil reserves, located mainly in the Fergana Valley, are estimated at 11.6 million tons and natural gas reserves at 4.9 billion m<sup>3</sup>, their exploitation is still unsatisfactory. For this reason, local coal reserves are used more widely in all industrial sectors, including the energy industry. About 70 coal basins with reserves of 30 billion tons are located in the country, mainly in the Osh, Jalal-Abad, Issyk-Kul, and Naryn regions [4, p. 68]. The main place in the energy complex of Kyrgyzstan is occupied by hydroelectric power plants and partly by thermal power plants. In 2021, the total generation capacity of hydroelectric power plants in Kyrgyzstan was 3869 MW (0.05%; 0.85%), of which the majority, namely 3135 MW, fell to hydroelectric power plants (81.0%) and only 734 MW to thermal power plants (18.9%) [8]. Of the 14815 million kWh of electricity produced in Kyrgyz hydroelectric power plants in 2021 (0.05% in the world; 0.8% in Eurasia), most of the electricity, namely 13976 million kWh, was provided by hydroelectric power plants (94.3%), and a small part was provided by thermal power plants (5.67%). The total hydropower potential of the country is estimated at 163 TWh/year, of which 99 TWh/year is technically feasible and 55 TWh/year is economically feasible [8]. The fact that the rivers of Kyrgyzstan have such a large hydropower potential opens up wide opportunities for more efficient use of this

energy in the future. The largest HPPs in the country are Ashakhinarin Cascade HPP (2870 MW), Toktogul (1200 MW), Kurpsay (800 MW), Tash-Kumir (450 MW), Shamaldisay (240 MW), Uch-Kurgan (180 MW), etc. The indicators for 2023 indicate a slight increase in the total production capacity of power plants operating in Kyrgyzstan. Thus, the energy capacity of renewable and non-renewable energy sources was increased to 4134 MW, of which 3210 MW was accounted for by HPPs and 924 MW by TPPs, respectively [12].

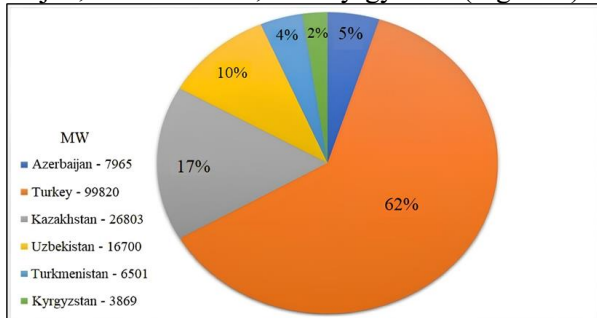
As can be seen, the Turkic states have quite rich natural fuel resources: oil, natural gas (Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan), uranium (Kazakhstan, Uzbekistan), coal (Turkey, Kazakhstan, and Uzbekistan), shale (Azerbaijan), etc. In our research, the current state of the total reserves of existing energy carriers of the Turkic world countries, per capita energy carrier consumption, total production capacity of power plants, and electricity generation at these plants were analyzed, and their share indicators with the countries of the world and among themselves were calculated in percentages. The conducted analyses show that currently the total reserves of energy carriers of the TWC are estimated at 59.02 billion tons of equivalent units, and most of this falls on Kazakhstan and Turkmenistan, and a relatively small part falls on Turkey, Azerbaijan, Uzbekistan, and Kyrgyzstan (Figure 1).

Observations show that there are also differences in the per capita consumption of energy carriers among the Turkic states. Thus, if in Turkmenistan and Kazakhstan these indicators are higher than the world and Eurasian indicators in 2021 (1.2-2.6 times), then in Azerbaijan, Uzbekistan, and Kyrgyzstan they are lower (1.1-4.1 times), and in Turkey they are higher (2.6 times) and lower (1.6 times), respectively.



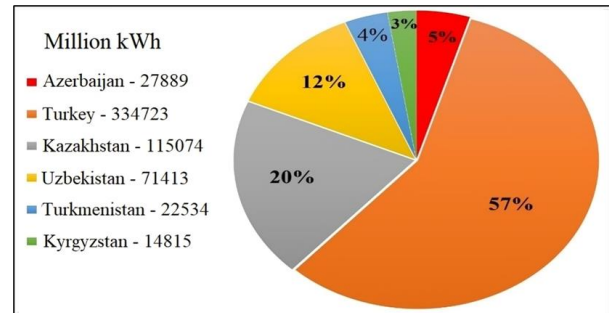
**Figure 1. Total reserves of energy carriers of the Turkic World Countries (billion tons of oil equivalent) and their share by country (%) in 2021**

Studies show that the total generation capacity of the ES operating in the Turkic world countries in 2021, which reached 161667.0 MW, is unevenly distributed across countries, with the highest percentages observed in Turkey and Kazakhstan and relatively low indicators in Uzbekistan, Azerbaijan, Turkmenistan, and Kyrgyzstan (Figure 2).



**Figure 2. Share of total production capacity of ES in the TWC by country (in %), 2021**

It should also be noted that in all Turkic states (except Kyrgyzstan: in this country, 81.0% of the production capacity of power plants is accounted for by HPPs), a significant part of the total energy capacity of existing power plants is accounted for by thermal power plants, and the rest is accounted for by other energy sources. The high share of thermal power plants in the fuel-energy balance of the countries is explained by the richness of fuel raw materials available in their territories. Observations show that one of the similar features among the Turkic states is that they have sufficient renewable energy sources. That is why interest in the use of environmentally friendly renewable energy sources such as solar and wind in Azerbaijan, Kazakhstan, and Uzbekistan; solar, wind, and hydropower in Turkey; and hydropower in Kyrgyzstan is growing. This is also proven by the fact that in recent years, the share of renewable energy sources in the energy capacity of countries has reached 20.5% in Turkey, 7.6% in Kazakhstan, and 1.4% in Azerbaijan (these figures are relatively low in Uzbekistan, Turkmenistan, and Kyrgyzstan, varying between 0 and 0.64%). As a result of the calculations, it was determined that in 2021, 586453.0 million kWh of electricity were produced in the power plants operating in the Turkic states, and the highest percentages were recorded in Turkey, Kazakhstan, and Uzbekistan, while the relatively low figures were recorded in Azerbaijan, Turkmenistan, and Kyrgyzstan (Figure 3).



**Figure 3. Share of electricity generation in TWC's power plants by country (in %), 2021**

**Conclusion and suggestions.** From the conducted analyses, it can be concluded that the countries of the Turkic world have rich fuel and energy resources, and the efficient use of these resources has led to substantial economic growth in the volume of GDP of the countries, the generation capacity of existing RES, annual electricity production, etc. The gradual expansion of the use of RES in the countries has created conditions for the satisfaction of the demand for electricity in the places, the reduction of dependence on imported energy, and, on the contrary, the export of excess electricity to countries around the world. In general, the strong development of the fuel and energy complex, which is one of the most strategic sectors of the economy in the Turkic states, has led to the further expansion of the cooperation relations of these states in the political-economic, transport, trade, and energy fields both in their internal geopolitical regions and within the framework of the TCT, and most importantly, to their successful integration into the world's most dynamic network of economic and trade relations. If the countries of the Turkic world continue to strengthen political and economic relations among themselves, including the implementation of many valuable projects such as the South Caucasus Corridor (SCC), the South Caucasus Pipeline (SCP), the Trans-Anatolian Pipeline (TANAP), the Trans-Adriatic Pipeline (TAP), etc., which are part of the Southern Gas Corridor (SGC), this may lead to the development of newer sectors of the economy in these countries, the independent use of their natural resources without being influenced by various power centers, and also a significant change in the geopolitical and economic situation of the world in their favor.

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## TÜRK DÜNYASI ÖLKƏLƏRİNİN YANACAQ-ENERJİ EHTİYATLARI VƏ ELEKTROENERGETİKA KOMPLEKSLƏRİNİN PRIORITYET İNKİŞAF İSTİQAMƏTLƏRİ

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**Xülasə.** Məqalədə Türk Dünyası Ölkələrinin (TDÖ) elektroenergetika komplekslərinin müasir vəziyyəti, mövcud enerjidaşıyıcılarının ümumi ehtiyatı və onun adambaşına düşən istehlakı, müxtəlif tip elektrik stansiyalarının generasiya gücü və elektrik enerjisi istehsalı kimi məsələlərə baxılır. Burada TDÖ-nün energetika komplekslərinə aid iqtisadi göstəricilər təhlil edilmiş, onların dünya ölkələri arasında pay göstəriciləri hesablanmışdır. Məqalədə həmçinin bu ölkələrdə mövcud olan yerli təbii ehtiyatların energetika komplekslərinin inkişafına təsirindən, bərpa olunan enerji mənbələrindən (BOEM) istifadənin genişləndirilməsi məsələlərindən, eləcə də Türk Dövlətləri arasında mövcud olan oxşar və fərqli xüsusiyyətlərdən bəhs edilir. Məqalənin yazılmasında energetikaya aid müvafiq ədəbiyyat nümunələrindən və aidiyyət agentliklərinin statistik materiallarından istifadə edilmiş, sxem və diaqramlar verilmişdir.

**Açar sözlər:** elektroenergetika, istilik-elektrik stansiyası (İES), su-elektrik stansiyası (SES), bərpa olunan enerji mənbələri, enerjidaşıyıcıları, istehsal, istehlak.